ERCB

Penn West Petroleum Ltd.
Well Blowout
14-20-065-10W5M
August 17, 2010

ERCB Investigation Report

August 24, 2011

Energy Resources Conservation Board

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1 Description of Incident

At about 10:00 p.m. on August 17, 2010, a contractor for Penn West Petroleum Ltd. (Penn West) experienced a loss of well control (blowout) while repairing a surface casing vent flow on a dual string water and carbon dioxide (CO_2) injection well. The well is located at Legal Subdivision 14, Section 20, Township 65, Range 10, West of the 5th Meridian, about 6 kilometres (km) southwest of the Town of Swan Hills.

During the incident, a total of 850 cubic metres (m^3) of produced water, 2 m^3 of diesel fuel, and 103 000 m^3 of CO_2 was released from the well as a fine mist spray, impacting a total land area of approximately 105 000 square metres.

Wellbore fluids sprayed both on and off lease, covering local vegetation and entering an unnamed watercourse located 110 m north of the well. This watercourse flows east into Freeman Creek.

CO_2 readings recorded during the incident varied between 0 and 8800 parts per million, depending on proximity to the well site and meteorological conditions. The off-lease monitoring indicated that CO_2 levels were below occupational exposure limits.

The incident was designated a level-2 emergency[1] using the Energy Resources Conservation Board (ERCB) Risk Assessment Matrix for Classifying Incidents. The incident occurred in a rural wooded area with no residences and received no media attention.

Well History

The 14-20 well was licensed as an oil well on Nov. 19, 1984, to Amoco Canada Petroleum Ltd. (Amoco). Penn West purchased the well from Amoco's successor in November 2002. On May 5, 2008, Penn West applied to the ERCB for an injection well approval, which was granted on May 16, 2008.

Both water and liquid CO_2 were injected into the well through two tubing strings into one zone. CO_2 was injected into the lower part of the zone to stimulate production, and water was injected into the upper part of the zone to prevent vertical migration of the CO_2. The wellbore contains two packers: one near the bottom of the water injection string and one near the bottom of the CO_2 injection string. Diesel fuel was pumped into the annulus between the tubing and the production casing to help prevent freezing and corrosion.

2 Pertinent Penn West Activities at the Well

Penn West conducted a packer isolation test on August 19, 2009. The test failed, indicating that either a packer or the production casing had been compromised.

Penn West did not repair the failure nor did it report the failure to the ERCB.

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[1] A level-2 emergency is defined as an incident where there is no immediate danger outside of the licensee's property or the right-of-way, but there is the potential for the emergency to extend beyond the licensee's property. Outside agencies must be notified. Imminent control of the hazard is probable, but there is a moderate threat to the public and/or the environment. There may be local and regional media interest in the event.

On July 14, 2010, the surface water injection line failed due to internal corrosion. Penn West continued injecting CO_2 until the well was shut in on August 16.

3 Cause of the Loss of Well Control

The ERCB has concluded that the following sequence of events led to the release:

1) Top packer failure in 2009 allowed CO_2 into the wellbore.

2) Production casing failure at approximately 60 m from surface. Although a metallurgical analysis could not definitively identify the cause of the failure, it is surmised that a combination of factors contributed to the production casing collapse.[2] The metallurgical analysis did identify some external corrosion at the failure point.

3) On August 16, subsequent to the production casing failing, wellbore fluids were released to surface from the surface casing vent and resulted in a surface casing vent discharge. A service rig was then placed on the well.

4) The initial release of wellbore fluids left the annulus partially empty. Once on site, the service rig filled the annulus with a mix of methanol and fresh water. Calcium chloride was then pumped down both tubing strings. During this time, no discharge was seen from the surface casing vent.

5) After removing the wellhead and installing a blowout preventer (BOP), the short tubing string was unlatched from the failed top packer. There was an immediate discharge of fluid from the surface casing vent. This resulted in a further loss of hydrostatic pressure in the annulus allowing the CO_2 to enter the annulus through the packer with the tubing string removed causing a substantial increase of flow into the wellbore.

6) Penn West closed the pipe rams on the BOP, but the breach in the production casing allowed wellbore fluids from the annulus to escape through the surface casing vent to surface and control of the well was lost.

4 Root Cause Analysis

The top packer failed and was not repaired when discovered. This failure ultimately led to the sequence of events resulting in the loss of well control.

5 Investigation Findings

The ERCB has determined that the August 19, 2009, failed packer test was not reported, nor was the packer repaired. Penn West, therefore, did not meet the requirements set out in *ID 2003-1: 1) Isolation Packer Testing, Reporting, and Repair Requirements; 2) Surface Casing*

[2] "It was not possible to determine the exact event that caused the collapse of the casing; however, a pressure differential over the surface casing annulus and production casing annulus was considered a possibility. The heating/cooling cycles involved with injecting water and CO_2 likely aided in collapse as associated tensile stresses would reduce the require pressure." Penn West Energy Post-Incident Investigation Report, Appendix 7, Acuren Group Inc., Materials Engineering & Testing Analysis Report, p. 21.

Vent Flow Gas Migration Testing, Reporting, and Repair Requirements; 3) Casing Failure Reporting and Repair Requirements. This information was forwarded to the ERCB St. Albert Field Centre for follow-up, and a High Risk Enforcement Action, as set out in *Directive 019: Compliance Assurance*, was issued on December 9, 2010, for the following items:

- Failure to complete the necessary reporting of required packer testing by September 1 of each year
- Failure to perform repairs and report repair results to the ERCB within 90 days of detection

On February 17, 2011 Penn West successfully addressed the enforcement action.

In certain situations the ERCB packer test tracking system, the ERCB Digital Data Submission (DDS) system, does not enable identification of noncompliant licensees when they have failed to report the results of their packer tests.

6 ERCB Follow-up

The ERCB is re-examining the DDS system for packer test reporting.